Experiment Safety Assessment Document (ESAD) for E04-108 and E04-019

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1 Introduction and Scope

Hall C experiment E04-108 will measure the ratio of proton's electric to magnetic form factor to the highest Q^2 presently possible at JLab. Hall C experiment E04-019 will test whether the ratio of proton's electric to magnetic form factor is constant for a fixed Q^2 at different beam energies. The experiments will use the following equipment:

- the standard Hall C beamline
- the standard Hall C Moller polarimeter
- the standard Hall C scattering chamber and target system
- the standard Hall C HMS detector package, except that the gas Cerenkov, S2 scintillator planes, and aerogel have been removed and replaced by a new focal plane polarimeter.
- a new large calorimeter (BigCal)
- a new electronics platform

This document does not replace, but supplements the standard "ESAD for the Hall C Base Equipment". Where appropriate, references will be made to the Hall C ESAD. Therefore collaborators are required to be familiar with both documents. Further, this document does not describe the function or operation of the various components. That information can be found in various "How-To" documents. The following will identify hazards associated with the new equipment only and explain the mitigation of such hazards.

1.1 Large calorimeter (BigCal)

BigCal is installed on the SOS side on the beamline as shown in Fig. 1. The calorimeter consist of 1744 lead glass blocks which are enclosed in a black light-tight box (BigCal light box). The blocks come from different sources so there are 720 " RCS" blocks with dimensions of 4x4x40cm and 1024 "Protvino" blocks with dimensions of 3.8x3.8x45cm. The physical size of BigCal is about 120cm (width) by 240cm (height).

BigCal is placed on a platform which raises the middle of the calorimeter to beam height. The platform is about nine feet high and is accessed from the rear by a platform ladder. There is railing at all areas of the platform, so that one can access the platform without fall protection. Also on the platform are six electronic racks which house signal cable patch panels and NIM crates which are used to amplify the signal, sum groups of eight signals and form the trigger.

1.2 Focal Plane Polarimeter (FPP)

The Focal Plane Polarimeter (FPP) in the HMS is a device to measure the spin polarization of protons. The FPP is actually two polarimeters in succession. Each consists of

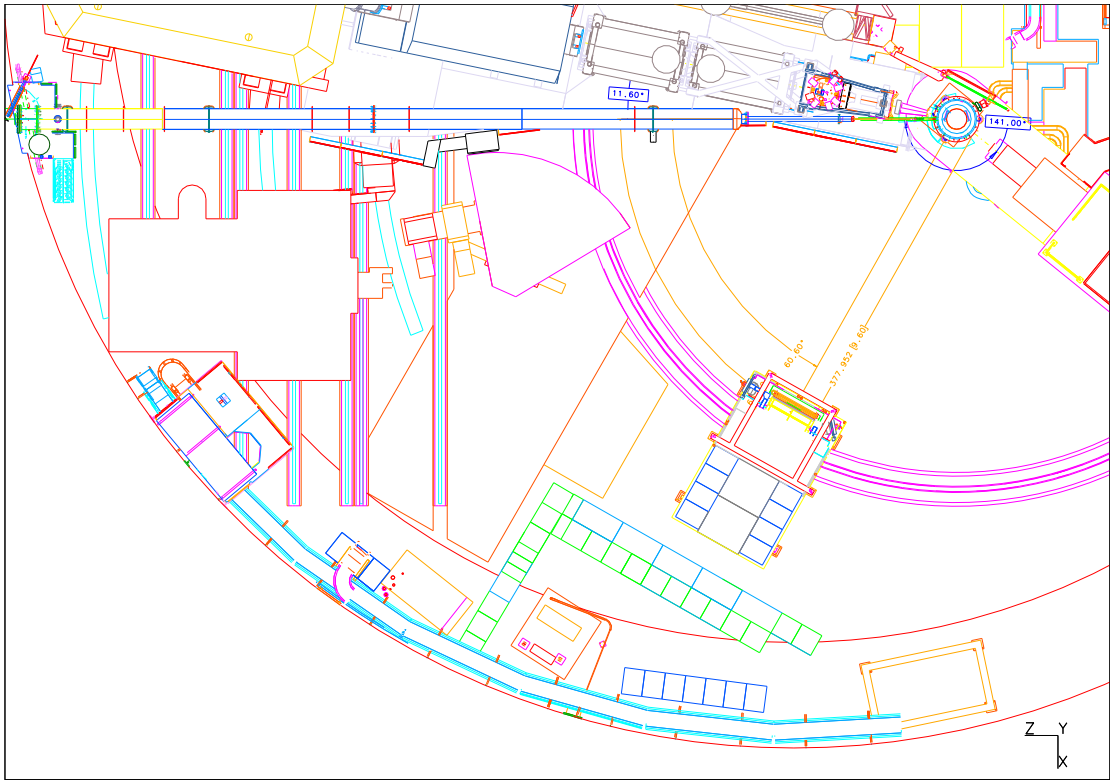

Figure 1: Schematic of the location of the BigCal for the first kinematic point.

a slab of analyzer material, an approximately 55 cm thick block of CH2 plastic, and a pair of identical drift chambers, each consisting of 3 layers, measuring along the vertical axis and 45° left and right from the horizontal.

The drift chambers are all identically constructed with an active area of 164cm (tall) by 132cm (wide).The chambers are assembled into rigid pairs via spacer blocks. This creates a reliable, fixed relative positioning. Also, the pair is held in place by tracks that interact with the top and bottom spacers which are equipped with corresponding bearings: a C-shapes sleeve bearing at the top and transverse wheels at the bottom. The chamber pairs are locked into position so that movement is impossible.

Each analyzer consists of CH2 material and is constructed of 2" thick sheets, all held together in an outer aluminum frame. The blocks are split vertically down the middle, resulting in the frame resembling two opposing "C" shapes. The halves are mounted on a track to allow straight through operation, in which configuration the two halves are retracted from the beam's path to be outside the acceptance. The size of each block pair is 145cm (tall) * 111cm (wide) * 55cm (thick). To reduce the occurrance of leakage through the seam when closed, an overlapping step was designed into this edge. Opening (retraction) of the analyzer material is achieved via a hand crank mechanism for each analyzer half. There is a limited amount of travel for the hand crank mechanism. Only experts will be allowed to operate the hand crank mechanism.

In the HMS hut, two VME crates were installed for reading signals from the FPP chambers. Two NIM crates installed for the formation of the HMS trigger for the HMS

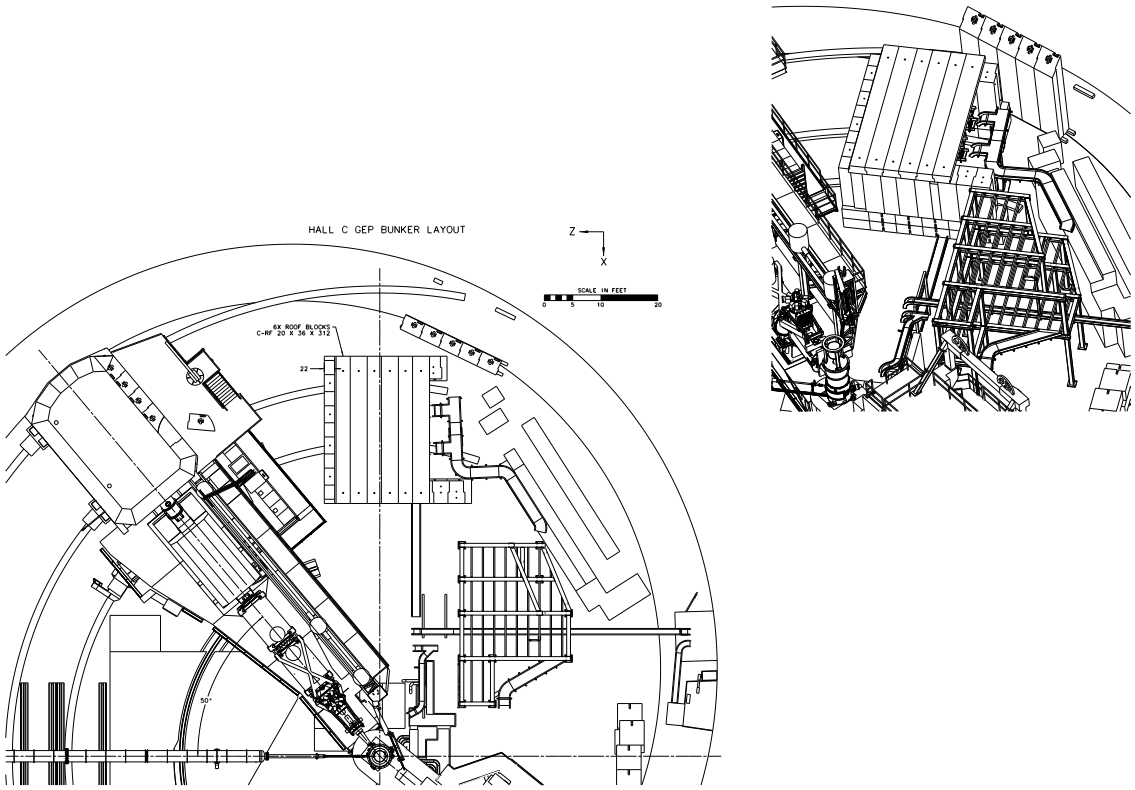

Figure 2: Schematic of the location of the hut for the electronics platform.

scintillators.

1.3 Electronics Platform

The electronics platform is on the HMS side of the beamline at about 90° as shown in Fig. 2. This platform is enclosed on three sides by a bunker of concrete blocks. There are two rows of 4 electronics racks on the platform. Two racks house six Lecroy (Universal Voltronics) high voltage crates and HV patch panels. Four racks are used to hold the patch panels for the signal cables. The trigger electronics and slow controls use two VME crates, two CAMAC crates, two FASTBUS crates and one NIM crate which are in two racks.

2 Electrical Systems

The newly installed detector systems and their associated electronics are similar to the existing equipment. Thus, the standard safety procedures should be followed as outlined in the "ESAD for the Hall C Base Equipment", Chapter 2.4 "Electrical System".

Hazard Mitigation

- All non-routine maintenance shall be performed in strict accordance with the Jefferson Lab EH&S Manual, and with particular attention to the chapters on Lockout, Tagout and ELectrical Safety.

2.1 Hazards from HV power supplies

The experiment utilizes CAEN high voltage crates on the second floor of the counting house for 640 channels and newly installed Lecroy (or Universal Voltronics) crates locateded on the electronic platform in the Hall C for the remaining 1104 channels. The FPP has the high voltage supplied by a CAEN crate in the Hall C Counting House. The operation of these supplies and their associated hazards are identical to those outlined in the "ESAD for the Hall C Base Equipment", Section 2.4.3 "High Voltage".

The Protvino bases are different than the RCS bases. In addition to the normal high voltage supplied to the base, the Protvino bases use four external power sources (booster supplies) to supply an additional 400 volts to the base. This present a hazard that users might not be normally anticipating when working around PMT bases.

Hazard Mitigation

- Cable and SHV connectors are shielded
- Turn off the main HV crate when attaching/removing HV cables.
- The personnel that are allowed to access the BigCal light box will be on a list posted at the door of the BigCal light box. Only Mark Jones can add personnel to the list. Personnel accessing the light box will follow a procedure of turning off all the HV crates and the four external power supplies (booster supplies).
- The external booster supplies and HV crates are interlocked to the door of the BigCal light box. This provides an automatic method of turning off the HV crates and the booster supplies in case the above procedures are not followed. Since it is impossible to work in the BigCal light box without the the door being open, the interlock prevents an outside person from turning on the HV or the booster supplies while someone is working on the BigCal bases or PMTs in the BigCal light box.

3 Radiation Safety

As with other areas of the hall, equipment in the Electronics Platform and the BigCal platform must be subject to a radiological survey prior to being removed from the Hall, if it has been, at any time, in the hall during beam-on conditions.

4 Gas system for the FPP

The FPP drift chambers use the standard Hall C gas mixture which contains the flammable gas ethane. The FPP gas inlets and outlets are connected to the standard Hall C gas handling system. The operation and safety of this system are described in the "Hall C Expert Howto Drift Chamber Gas System Operation" and the gas system SOP.

5 Moving the BigCal

The BigCal will be moved to seven different angle and positions during the two experiments. The total weight of everything on the BigCal platform is 22,500 pounds. A lifting frame is permanently attached to the BigCal platform and, using the standard Hall C 20 ton crane, BigCal will be moved to the different locations. All crane operations will be supervised by Walter Kellner using standard Jefferson Lab practices. The electronics racks on the BigCal platform are powered by a local mobile transformer. Before the BigCal platform is moved either Bill Vulcan or Joe Beaufait will disconnect the power to the BigCal platform and reconnect it after the move.